Research on Operational Aspects of Large Autonomous Underwater Glider Fleets

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LONG-TERM GOALS

Our long-term goal is to develop an efficient, sustainable, and relocatable observing system suitable for a variety of exploratory, process-oriented oceanographic studies and naval applications. Our basic strategy is to combine technology development with significant field experiments which advance our understanding of the ocean environment.

OBJECTIVES

This program supported research on the operational and management issues stemming from application of large fleets of autonomous underwater gliders to oceanographic research and rapid environmental characterization in support of naval objectives.

APPROACH

Gliders may be operated as traditional survey vehicles along pre-determined or adaptively-modified tracklines or as synthetic moorings. *Gliders are slow.* It is difficult to synoptically observe even a small ocean region using a single glider. Thus unlike surveys involving faster AUV's (e.g. REMUS, Bluefin, Dorado), effective glider applications do not attempt to mimic linear or areal surveys such as performed by a ship. Rather, an efficient sampling approach using gliders involves simultaneous operation of many vehicles resulting in a multiplicatively-higher effective survey speed and a more robust measurement of the ocean environment. This in turn requires a communications and control infrastructure capable of handling multiple vehicles in a coordinated and intelligent manner. The WHOI glider fleet communicates via satellite using the Iridium satellite phone service and is controlled via a central, shore-based mission control system which provides near-real-time web dissemination of vehicle status and quality-controlled oceanographic data. All relevant vehicle and fleet operations can be performed from anywhere in the world with internet connectivity. We continued to make improvements to this system during the past year.

Independent of a vehicle control system there are additional significant logistical and operational issues that are particularly relevant to the operation of large glider fleets. For example, vehicle preparation and maintenance can be extremely time consuming if efficient procedures are not developed and carefully followed. Similarly, at-sea operations require efficient, safe, and robust means of vehicle deployment and recovery. We continued work on improving system robustness by developing and refining standard operational procedures that can eventually be transitioned to naval personnel.

WORK COMPLETED

Support for this program began in March 2005. Work focused on development of new sensor capabilities for the WHOI glider fleet and continuing improvement of vehicle and fleet control capabilities. In late 2005 we prepared a glider which successfully completed a demonstration project with COMSUBPAC. We also completed several local field demonstrations of multi-vehicle coordinated control in collaboration with partners at Princeton University (Naomi Leonard, Fumin Zhang). These results have been submitted for publication.

IMPACT/APPLICATIONS

Continued development of multi-vehicle network operations will improve measurement and understanding of transient ocean phenomena such as mesoscale eddies and fronts and streamline distributed environmental observations in remote or hostile locations. A network of gliding vehicles can supply, in an efficient and cost-effective manner, high-quality, near-real-time environmental information for operational ocean/atmosphere forecasting and model validation.

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